

Amendment Under 37 C.F.R. § 1.111
USSN 10/607,205
Attorney Docket Q76357
July 7, 2005

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-53. (Canceled)

54. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first means for transferring the bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising a bending unit (22), and second means for transferring bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

wherein said first means for transferring comprise:

- a supporting frame (13) in the installation,
- a gripper (2), including:
- a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and

- a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,

- wherein said pair of jaws (2a) of each gripper (2) are mounted on a wrist member (3) which in turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4), and

- wherein means are provided for controlling the rotation of said wrist member of each gripper about said axis of articulation (4) so as to be capable of orienting said gripper (2) in an angular position around said axis of articulation (4) relative to the gripper supporting structure, while the gripper supporting structure is movable along said longitudinal and transverse directions (A, X) relative to the bending station,

- wherein the gripper (2) is able to be moved along any of said two directions (A, X) to grip the bars (B) at said first station (20), keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars (B) at said bending station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation, and

wherein the same grippers (2) are arranged so that they can be used both as the first means for transferring the bars (B) from the first station (20) to the bending station and as the second means for transferring the bars (B) from said bending station to the third unloading station (28).

55. (New) An installation as claimed in claim 54, wherein the supporting frame for the gripper is a frame overlying the first station, the bending station and the unloading station.

56. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first means for transferring the bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising a bending unit (22), and second means for transferring bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

wherein said first means for transferring comprise:

- a supporting frame (13) in the installation,
- gripper means (2), each including:
 - a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
 - a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,
 - wherein said pair of jaws (2a) of each gripper (2) are mounted on a wrist member (3) which in turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4), and
 - wherein means are provided for controlling the rotation of said wrist member of each gripper about said axis of articulation (4) so as to be capable of orienting said gripper (2) in an

angular position around said axis of articulation (4) relative to the gripper supporting structure, while the gripper supporting structure is movable along an of said longitudinal and transverse directions (A, X) relative to the bending station,

- wherein the gripper (2) is able to be moved along an of said two directions (A, X) to grip the bars (B) at said first station (20), keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars (B) at said bending station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation, and

wherein said first station (20) is a supporting surface (50) whereon the bars are supplied to be cut into segments of predetermined length.

57. (New) An installation as claimed in claim 54, in which the bending unit (22) comprises a revolving disk for supporting the bars to be bent, with a central axial mandrel (23) about which the bars are bent and an eccentric bending pin (24) for bending the bars about the mandrel, as well as an abutment element (25) against which the bars bear laterally during the bending operation, said central mandrel (23) and said abutment element (25) defining between them a gap for receiving the bars to be bent, arranged side by side to each other in a plane substantially perpendicular to the plane of the bending disc (21).

58. (New) An installation as claimed in claim 56, in which the bending unit (22) comprises a revolving disk for supporting the bars to be bent, with a central axial mandrel (23) about which the bars are bent and an eccentric bending pin (24) for bending the bars about the mandrel, as well as an abutment element (25) against which the bars bear laterally during the

bending operation, said central mandrel (23) and said abutment element (25) defining between them a gap for receiving the bars to be bent, arranged side by side to each other in a plane substantially perpendicular to the plane of the bending disc (21).

59. (New) An installation as claimed in claim 54, wherein said gripper supporting structure (5) is movable also in a third direction which is perpendicular to a working plane (21) of said bending station.

60. (New) An installation as claimed in claim 56, wherein said gripper supporting structure (5) is movable also in a third direction which is perpendicular to a working plane (21) of said bending station.

61. (New) An installation as claimed in claim 59, wherein the working plane (21) of said bending station is horizontal, so that the third direction of motion of the gripper supporting structure (5) is a vertical direction.

62. (New) An installation as claimed in claim 59, wherein the working plane (21) of said bending station is inclined relative to a horizontal plane, so that the third direction of the motion of the gripper supporting structure (5) is inclined relative to the vertical direction.

63. (New) An installation as claimed in claim 54, wherein the gripper supporting structure (5) is mounted on a carriage (6) which is movable along an overhead cross member structure (8) which in turn is movable in the manner of an overhead traveling crane relative to the supporting frame (13).

64. (New) An installation as claimed in claim 56, wherein the gripper supporting structure (5) is mounted on a carriage (6) which is movable along an overhead cross member

structure (8) which in turn is movable in the manner of an overhead traveling crane relative to the supporting frame (13).

65. (New) An installation as claimed in claim 59, wherein the gripper supporting structure (5) is slidably mounted along said third direction on a carriage (6) which is movable along an overhead cross member structure (8) which in turn is movable in the manner of an overhead traveling crane relative to the supporting frame (13).

66. (New) An installation as claimed in claim 65, wherein the two directions of movement of said carriage (6) and said overhead cross-member structure (8) are horizontal and said third direction of movement of said gripper supporting structure is vertical.

67. (New) An installation as claimed in claim 65, wherein the two directions of movement of said carriage (6) and said overhead cross-member structure (8) are horizontal and said third direction of movement of said gripper supporting structure is inclined both to the vertical and the horizontal.

68. (New) An installation as claimed in claim 63, wherein the gripper supporting structure comprises a plurality of grippers (2), with their respective carriages (6) carried on a common overhead cross-member structure (8).

69. (New) An installation as claimed in claim 64, wherein the gripper supporting structure comprises a plurality of grippers (2), with their respective carriages (6) movable along respective overhead cross-member structures (8) able to slide in the manner of overhead traveling cranes on the support frame (13).

70. (New) An installation as claimed in claim 56, wherein the bending station comprises two mutually spaced apart bending units (22), positioned laterally relative to the bench (50), whereon the cut bars are set down to be bent according to predetermined shapes and in that the two bending units (22) are movable with respect to one another along the longitudinal direction (A) of the bars.

71. (New) An installation as claimed in claim 56, wherein on said supporting surface (50) means are provided for locating longitudinally in position the bars to be cut (B), in such a way that the cut bars are already in the correct position, with reference to the longitudinal direction (A), relative to the bending units (22), said transferring means thus transferring the bars from the supporting surface (50) to the bending machines (22) without changing their longitudinal position.

72. (New) An installation as claimed in claim 56, wherein the first station further includes a support plane arranged adjacent to said supporting surface for receiving the cut bars, said plane being defined by the upper branches of a plurality of endless chains (30) arranged in vertical planes parallel to said transverse direction (X).

73. (New) An installation as claimed in claim 56, further comprising unloading means for unloading bars which are not to be subjected to a bending operation from said supporting surface on a side thereof opposite to that facing the bending station.

74. (New) An installation as claimed in claim 73, wherein said unloading means comprises roller tracks to receive bars which are not to be subjected to a bending operation.

75. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first means for transferring the bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising bending units (22), and second means for transferring bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

wherein said first means for transferring comprise:

- a supporting frame (13) in the installation,
- grippers (2), each including:
 - a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
 - a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,
 - wherein said pair of jaws (2a) of each gripper (2) are mounted on a wrist member (3) which on its turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4), and in that
 - wherein means are provided for controlling the rotation of said wrist member of each gripper about said axis of articulation (4) so as to be capable of orienting said gripper (2) in any

angular position around said axis of articulation (4) relative to the gripper supporting structure, while the gripper supporting structure is movable along any of said longitudinal and transverse directions (A, X) relative to the bending station,

- wherein the gripper (2) is able to be moved along any of said two directions (A, X) to grip the bars (B) at said first station (20), keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars (B) at said bending station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation,

wherein said gripper supporting structure (5) is movable also in a third direction which is perpendicular to a working plane (21) of said bending station, said third direction being inclined both to the vertical and the horizontal.

76. (New) An installation according to claim 75, wherein the gripper supporting structure (5) is slidably mounted along said third direction on a carriage (6) which is movable along an overhead cross member structure (8) which in turn is movable in the manner of an overhead traveling crane relative to the supporting frame (13), and

wherein the two directions of movement of said carriage (6) and said overhead cross-member structure (8) are horizontal.

77. (New) An installation as claimed in claim 76, wherein the first station includes a support plane defined by upper branches of a plurality of endless chains (30) arranged in vertical planes parallel to said transverse direction (X).

78. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first means for transferring the bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising bending unit means (22), and second means for transferring the bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

in which said first transferring means comprise:

- a supporting frame (13) in the installation,
- grippers (2), including:
 - a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station, at least along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation, and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
 - a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,
 - wherein said pair of jaws (2a) of the gripper (2) are mounted on a wrist member (3) which on its turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4), and
 - wherein means are provided for controlling the rotation of said wrist member of each gripper about said axis of articulation (4) so as to be capable of orienting said gripper (2) in any

angular position around said axis of articulation (4) relative to the gripper supporting structure, while the gripper supporting structure is able to be moved along any of said longitudinal and transverse directions (A, X) relative to the bending station,

- so that the gripper (2) is able to be moved along any of said two directions (A, X) to grip said bars (B) at said first station (20), keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars (B) at said bending station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation,

wherein said gripper supporting structure (5) is movable also in a third direction which is perpendicular to a working plane (21) of said bending station, and

wherein the wrist member (3) of each gripper (2) is pivotally mounted around said articulation axis (4) on a structure which is pivotally supported by said gripper supporting structure (5) around an axis parallel to said third direction.

79. (New) An installation as claimed in claim 78, wherein means are provided for controlling the grippers, programmable to calculate the position of the centre of gravity of the bars.

80. (New) An installation as claimed in claim 78, wherein sensor means are associated with said gripper to sense positions along the bars where the bars can be gripped.

81. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first transferring means for transferring said bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising bending units (22), and second means for transferring said bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

in which said first transferring means comprise:

- a supporting frame (13) in the installation,
- grippers (2), each including:
 - a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station, at least along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation, and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
 - a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,
 - wherein said pair of jaws (2a) of the grippers (2) are mounted on a wrist member (3) which on its turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4), and
 - wherein controlling means are provided for controlling the rotation of said wrist member of each gripper about said axis of articulation (4) so as to be capable of orienting said gripper (2) in any angular position around said axis of articulation (4) relative to the gripper

supporting structure, while the gripper supporting structure is able to be moved along any of said longitudinal and transverse directions (A, X) relative to the bending station,

- so that the gripper (2) is able to be moved along any of said two directions (A, X) to grip one or more bars (B) at said first station (20), keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars (B) at said bending station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation,

wherein the bending station comprises two bending units (22) spaced apart from each other and aligned in the longitudinal direction (A) of the bars (B), as well as a plurality of tables which are movable between a raised operative position where they define a support plane for the bars in the space along the longitudinal direction (A) between the two bending units or also longitudinally outside of said space, and a lowered inoperative position, where they do not interfere with the movement of the bending units in the longitudinal direction.

82. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first transferring means for transferring said bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising bending units (22), and second means for transferring said bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

in which said first transferring means comprise:

- a supporting frame (13) in the installation,

- grippers (2), each including:
- a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station, at least along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation, and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
 - a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,
 - wherein said pair of jaws (2a) of the gripper (2) are mounted on a wrist member (3) which is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4), and
 - wherein controlling means are provided for controlling the rotation of said wrist member of each gripper about said axis of articulation (4) so as to be capable of orienting said gripper (2) in any angular position around said axis of articulation (4) relative to the gripper supporting structure, while the gripper supporting structure is able to be moved along any of said longitudinal and transverse directions (A, X) relative to the bending station,
 - so that the gripper (2) is able to be moved along any of said two directions (A, X) to grip one or more bars (B) at said first station (20), keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars (B) at said bending station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation,

wherein an auxiliary support is associated to a bending unit (22) said auxiliary support being movable between an inoperative retracted position and an operative position in which the auxiliary support surmounts at least partially a revolving disk of the bending unit, in such a way that, in a cycle of bending operations necessary to obtain a closed loop stirrup of quadrangular shape starting from a rectilinear bar, it is assured, in the final phase of the bending cycle, that the end portions of the bar constituting each stirrup are mutually approached without risk of interference between the bar portions in motion and a central mandrel of the bending unit and/or the opposite ends of the bars.

83. (New) An installation as claimed in claim 57, wherein the bending unit comprises adjustment means for adjusting the distance between the mandrel (23) and a butting organ (25) in a direction transverse to the longitudinal direction (A) and control means for commanding said adjustment means to adjust automatically the width of the space for receiving the bars as a function of the diameter of the bars.

84. (New) A method for transferring a plurality of bars (B) in an installation for processing metal bars for concrete reinforcement, in which said installation comprises first transferring means for transferring bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising bending units (22), and second means for transferring bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

in which said first transferring means comprise:

- a supporting frame (13) in the installation,

- grippers (2), each including:
- a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station, at least along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation, and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
- a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition,
- wherein said pair of jaws (2a) of each gripper (2) are mounted on a wrist member (3) which on its turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4),
- wherein the rotation of said wrist member of each gripper about said axis of articulation (4) is controlled for orienting said gripper (2) in any angular position around said axis of articulation (4) relative to the gripper supporting structure, while the gripper supporting structure is movable along any of said longitudinal and transverse directions (A, X) relative to the bending station, and
- wherein said first transferring means are controlled in such a way as to grip the bars (B) at said first station (20), which are arranged substantially side by side in a first plane having a first orientation, and to deposit said bars at said bending station, arranged substantially side by side in a second plane having a second orientation which can be different from said first orientation.

85. (New) A method as claimed in claim 84, wherein said first station (20) is a supporting surface (50) whereon the bars are supplied to be cut into segments of predetermined length.

86. (New) A method as claimed in claim 84, wherein the bent bars are gripped in proximity to the projection of their centre of gravity along the transverse direction (X) and/or the longitudinal direction (A).

87. (New) A method as claimed in claim 84, wherein controlling means are provided for controlling the grippers which are programmable to calculate the position of the centre of gravity of the bars.

88. (New) A method as claimed in claim 84, wherein the transferring movements of the bars from the first station (20) to the bending station and from the bending station to the unloading station (28) are carried out by the same grippers (2).

89. (New) A method as claimed in claim 84, in which each bending unit (22) comprises a swiveling disk for supporting the bars to be bent, with a central axial mandrel (23) about which the bars are bent and an eccentric bending pin (24) for bending the bars about the mandrel, as well as an abutment element (25) against which the bars bear laterally during the bending operation, said central mandrel (23) and said abutment element (25) defining between them a gap for receiving the bars to be bent, in which the bars are set side by side to each other in a plane substantially perpendicular to the plane of the bending disk.

90. (New) A method as claimed in claim 84, wherein said bars are gripped at said first station (20) by means of said grippers (2) after the bars are all oriented with the fins of the ribs in the same direction.

91. (New) A method as claimed in claim 84, wherein said gripper supporting structure (5) is also movable in a third direction that is perpendicular to a working plane (21) of the bending station.

92. (New) A method as claimed in claim 84, wherein each bending unit (22) is provided with locating means in form of bar butting means, for locating the bars in the correct longitudinal position.

93. (New) A method as claimed in claim 84, wherein points at which the bars are gripped in the first station are calculated as a function of parameters unloading weight distribution, length and diameter of the bars.

94. (New) A method as claimed in claim 93, wherein when unloading the bent bars from the bending station, the distance along the longitudinal direction (A) between grippers (2) and mandrels (23) of the bending units is calculated as a function of parameters including bar diameter, bar length, and length of the overhanging segment beyond the closest gripper.

95. (New) A method as claimed in claim 84, wherein programmable means are provided for controlling the motion of the grippers (2), which control the velocity of motion as a function of parameters including bar diameter, length of the tail segment of the bar positioned beyond the closest gripper, weight of the bars, shape of the bar (in the case of bent bars), and number of the bars.

96. (New) A method as claimed in claim 84, wherein a single bending unit (22) is provided at said bending station, and a gripper (2) is used to translate the bars in the longitudinal direction (A) relative to said bending unit, in order to achieve the required bends in different segments of the bars.

97. (New) An installation for processing metal bars for concrete reinforcement, comprising:

first transferring means for transferring bars (B) from a first station (20) which receives bars which are to be subjected to a bending operation in said installation to a bending station, comprising bending units (22), and second means for transferring bars (B) from said bending station, once the bars have been bent therein, to a third unloading station (28),

in which said first transferring means comprise:

- a supporting frame (13) in the installation,
- grippers (2), each including:
 - a gripper supporting structure (5) guided on said supporting frame, so as to be movable in the installation, relative to the bending station, at least along a first direction (A) which is horizontal and parallel to a longitudinal direction of the bars in the installation, and along a second direction (X) which is horizontal and perpendicular to the longitudinal direction (A) of the bars, and
 - a pair of jaws (2a) mounted on said gripper supporting structure (5) and movable between an opened condition and a closed condition, and

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- wherein said pair of jaws (2a) of each gripper (2) are mounted on a wrist member (3) which in turn is pivotally mounted on said gripper supporting structure (5) around a substantially horizontal axis of articulation (4).

98. (New) An installation according to claim 75, wherein the movable support structure is mounted on a carriage which is movable along an overhead cross member structure which in turn is movable in the manner of an overhead traveling crane on overhead beams of a frame which overlies the installation, said overhead beams extending parallel to the working plane of said bending station.